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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/363,277	07/28/1999	KAI WURSTER	GR.98P.1801.	7931

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EXAMINER

KENNEDY, JENNIFER M

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 06/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/363,277

Applicant(s)

WURSTER ET AL.

Examiner

Jennifer M. Kennedy

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 November 2001.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) 1-7 and 21 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 8-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/232,081.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 9.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Drawings***

Figures 6-12 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). The applicant in the reply dated 11/30/2001 stated that substitute drawings were included, however the drawings were never received.

### ***Response to Amendment***

In view of Applicant's amendment to the claims, the rejections of claims under 35 U.S.C. 112 second paragraph, as being indefinite, are withdrawn.

Applicant's arguments with regard to the rejections under 35 U.S.C. 102 or 103 have been fully considered, but they are not deemed to be persuasive. The response to these arguments will be incorporated in the new ground of rejection given below.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 8-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicants' admitted prior art (see specification pages 1-36 and Figures 6-12) in view of Canale et al (U.S. Patent No. 6,040,213) or Hoepfner (U.S. Patent No. 6,008,103).

The applicants' admitted prior art discloses the method of forming a trench capacitor including the steps of:

- providing a substrate (101);
- forming a trench (108) with a lower region and an upper region in the substrate;
- filling the lower region of the trench with a first filling material (152);
- forming an insulation collar (168) in the upper region of the trench;
- removing the first filling material from the lower region of the trench (see Figure 7c and specification page 18, line 8-10);
- lining the lower region of the trench and an inner side of the insulation collar with a dielectric layer (164) as a capacitor dielectric;
- filling the trench with a conductive second filling material (161) as a capacitor plate; and
- providing a buried contact region for the capacitor plate underneath a surface of the substrate (250).

The applicants' admitted prior art also discloses the method including forming a buried plate (165) in a vicinity of the lower region of the trench as a further capacitor plate, the method of forming an tunnel layer (151) on an interface of the buried contact of oxide (see specification page 15, line 23 through page 16, line 2), and forming above

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the insulation collar on the conductive second filling material, with a third conductive filling material, a strap (162) to the buried contact region.

Further the applicants' admitted prior art (see specification page 32-33 and Figures 11a-11c) also discloses the method including

filling the trench with a fourth filling material (210) being selectively removable with respect to the substrate, the insulation collar and the dielectric layer, after the steps of forming the insulation collar and lining the lower region of the trench and the inner side of the insulation collar with a dielectric layer;

recessing the fourth filling material, the insulation collar, and the dielectric layer for defining an interface between the buried contact region and the substrate;

removing the fourth filling material; and

filling the trench with the conductive second filling material

The applicants' admitted prior art also discloses the method including widening the lower region of the trench (W2) relative to the upper region of the trench for forming a bottle shaped trench (see Figure 8) and the method of forming a buried strap in the trench (162).

The applicants' admitted prior art discloses the invention substantially as claimed, but does not disclose the method of forming a buried contact by introducing a dopant into the substrate in a region underneath a surface of the substrate in a vicinity of the buried contact by at least one process selected from the group consisting of implantation, plasma doping and vapor phase deposition, further including oblique doping and an isotropic doping.

Canale et al discloses the method of forming a buried contact by the method of oblique implantation (see Figure 5 and column 4, line 38-44). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the oblique doping method of Canale et al to form the buried contact region of the applicants' admitted prior art in order to connect the storage region to the transfer gate region.

Hoepfner discloses the method of utilizing an isotropic process to introduce dopant into the substrate (see column 6, line 42-53). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a isotropic process such as plasma immersion ion implantation to introduce dopant into a substrate in order to create the desired doping uniformity along the surfaces of the trench interior.

The applicants' admitted prior art and Canale et al. or Hoepfner disclose the method substantially as claimed, but does not disclose the method of utilizing a screen oxide during the implantation, however the examiner takes official notice of facts outside the record which are capable of instant and unquestionable demonstration as being "well-known" in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a screen oxide during implantation. Screen oxides are well known and commonly used to prevent damage to the substrate during implantation.

The applicants' admitted prior art and Canale et al. or Hoepfner disclose the method substantially as claimed, but does not disclose the method of introducing a

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dopant includes vapor phase doping through an exposed interface of the buried contact with  $\text{AsH}_3$  and  $\text{PH}_3$ . The examiner takes official notice of facts outside the record which are capable of instant and unquestionable demonstration as being "well-known" in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to introduce dopant into the substrate using vapor phase doping. Vapor phase doping is well known and used in the art to dope regions a substrate. Further,  $\text{AsH}_3$  and  $\text{PH}_3$  are commonly used dopants during vapor phase deposition.

The applicants' admitted prior art and Canale et al. or Hoepfner disclose the method substantially as claimed, but does not disclose the method of performing the steps of providing the buried contact and forming the tunnel layer in a single process sequence without removing the substrate from the process chamber. The examiner takes official notice of facts outside the record which are capable of instant and unquestionable demonstration as being "well-known" in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the process steps in a single sequence without removing the substrate from the process chamber. The method of performing a sequence of steps without removing the substrate is commonly done to reduce contamination of the substrate surface.

The applicant argues that Canale et al discloses that the dopant is diffused into the N-layer enlarging the doped region (32). The examiner agrees that a diffusion step is present in the Canale et al reference, however the claim only requires that a doped region in the buried contact region by introducing a dopant into the substrate in a region underneath a surface of the substrate by at least one process selected from the group

consisting of implantation, plasma doping, and vapor phase deposition. The claim does not preclude an additional step of out-diffusing. The examiner maintains that both Canale et al. and Hoepfner disclose the step of forming a doped region in the buried contact region by introducing a dopant into the substrate in a region underneath a surface of the substrate by at least one process selected from the group consisting of implantation, plasma doping, and vapor phase deposition.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.



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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Kennedy whose telephone number is (703) 308-6171. The examiner can normally be reached on Mon.-Fri. 8:30-5:00.

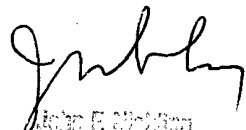
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (703) 308-3325. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7724 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



jmk

January 2, 2002



John F. Niebling  
Supervisory Patent Examiner  
Technology Center